G4LC32SX USER'S GUIDE

Form 581-030410 — April, 2003

OPTO 22

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G4LC32SX User's Guide
Form 581-030410 — April, 2003

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Table of Contents

Welcome 7

About This Manual 7

Document Conventions 7

Unpacking 8

Chapter 1: G4LC32SX Revised Features 9

Chapter 2: Introduction 11

The G4LC32SX Model 200 Controller 11

How A User Application Works 12

I/O Units 12

The G4LC32SX and Controller Software 12

Available Options 13

Basic Architecture 14

G4LC32SX Features 15

Chapter 3: Configuration and Installation 17

Diagrams 17

G4LC32SX Controller 17

G4LC32SER Diagram 19

G4LC32ARC Diagram 20

Configuration Switches and Jumpers 21

G4LC32SX Switches 21

G4LC32SER and G4LC32ARC Daughter Card Switches 22

G4LC32SX Jumpers 23

Installation 24

G4LC32SX Installation 24

G4LC32SX Daughter Board Installation 26

RAM and Flash EPROM Installation 27

Chapter 4: Serial Communications 29
Overview 29
Cables and Connectors 30
Wiring 32
Connections to a Host PC 34
Local Communications 38
Overview 38
Connectors and Cables 38
Wiring 39
ARCNET 40
Overview 40
Cables and Connectors 40
LEDs 41
G4LC32SX LEDs 41
G4LC32SER LEDs 42
G4LC32ARC LEDs 42
LED Functional Descriptions 43

Chapter 5: Software and Firmware 45
Cyrano 200 Software 45
Mistic MMI Software 45
Firmware Updates 45
RAM and Flash EPROMs 46
Running from Flash EPROM and Making Changes 46

Chapter 6: Hardware Specifications 47
G4LC32SX Hardware Specifications 47
G4LC32SER Hardware Specifications 48
G4LC32ARC Hardware Specifications 48

Figure and Tables

Figure 2-1: G4LC32SX Controller 11
Figure 2-2: G4LC32SX Block Diagram 14
Figure 3-1: G4LCSX Controller 17
Figure 3-2: G4LC32SX Inside Panel 18
Figure 3-3: G4LC32SER Physical Layout 19
Figure 3-4: G4LC32ARC Physical Layout 20
Figure 3-5: Controller Address Selecotr 21
Figure 3-6: Autoboot and Host Switches 21
Figure 3-7: Baud Rates 22
Figure 3-8: Mounting the G4LC32SX and Power Supply in a Mistic Panel 25
Figure 3-9: G4LC32SX Daughter Card Installation 26
Figure 3-10: Connecting the RAM Backup Battery 26
Figure 3-11: Location of EPROMS and RAM 27
Figure 4-1: G4LC32SX at End of network 29
Figure 4-2: G4LC32SX in Middle of network 30
Figure 4-3: G4LC32SX with >100 Units in Middle of network 30
Figure 4-4: Terminal Block 32
Figure 4-5: G4LC32SX RS-232 Fuses 33
Figure 4-6: RS-422/485 Wiring to Host PC (4-wire mode) 34
Figure 4-7: RS-422/485 Wiring to Host PC (2-wire mode) 35
Figure 4-8: Two-wire Mode using AC24AT or AC422AT 35
Figure 4-9: RS-232 Wiring to Host PC 36
Figure 4-10: Connections to Remote Interface (G4IOR) 37
Figure 4-11: G4LC32SX LEDs 41

Table 1-1: G4LC32SX Revised Features 9
Table 1-2: RAM Expansion Options 10
Table 1-3: EPROM Expansion Options 10
Table 3-1: Bootup Jumper 23
Table 3-2: Communication Mode Jumpers 23
Table 3-3: EPROM Jumpers 23
Table 3-4: RAM Jumper 24
Table 4-1: RS-232 Pin Connections 32
Table 4-2: RS-422/485 Pin Connections 33
Table 4-3: Local I/O Bus Specifications 38
Table 4-4: Manufacturers of Connectors and Cables 39
Table 4-5: Wiring of Signal Functions 39
Table 4-6: ARCNET Port Specifications 40
Table 4-7: Maximum ARCNET Cable Distances 40
Table 4-8: Processor Status LEDs 41
Table 4-9: G4LC32SER LEDs 42
Table 4-10: G4LC32ARC LEDs 42

Welcome

About This Manual

This guide includes the following sections:

Introduction — Describes and presents the parts included with the G4LC32SX controller and the daughter boards.

Chapter 1, "Configuration and Installation"—describes controller settings and installation instructions for the G4LC32SX.

Chapter 2, "Communications and Cables"—provides information for making communications cables and gives an overview of the communication modes available on the G4LC32SX.

Chapter 3, "Software and Firmware"—describes the software and Flash EPROMs used to run the G4LC32SX.

Chapter 4, "Hardware Specifications"—lists the features of the G4LC32SX and its daughter boards.

Document Conventions

- **Bold** typeface indicates text to be typed. Unless otherwise noted, such text may be entered in upper or lower case. (Example: "At the DOS prompt, type **cd\windows**.")
- *Italic* typeface indicates emphasis and is used for book titles. (Example: "See the *OptoControl User's Guide* for details.")
- File names appear in all capital letters. (Example: "Open the file TEST1.TXT.")
- Key names appear in small capital letters. (Example: "Press SHIFT.")
- Key press combinations are indicated by plus signs between two or more key names. For example, SHIFT+F1 is the result of holding down the SHIFT key, then pressing and releasing the F1 key. Similarly, CTRL+ALT+DELETE is the result of pressing and holding the CTRL and ALT keys, then pressing and releasing the DELETE key.
- "Press" (or "click") means press and release when used in reference to a mouse button.
- Menu commands are sometimes referred to with the Menu→Command convention. For example, "Select File→Run" means to select the Run command from the File menu.
- Numbered lists indicate procedures to be followed sequentially. Bulleted lists (such as this one) provide general information.

Unpacking

G4LC32SX

The packing box for the G4LC32SX controller contains:

- G4LC32SX controller
- Battery replacement label
- Four RS-485/RS-232, 7-position mini-plugs
- One 7-position power connector
- Connector key
- Jumpers
- Mistic 200 Controller Firmware Update Diskette (P/N 8823)

G4LC32SER

The packing box for the G4LC32SER contains:

- G4LC32SER daughter card
- Four RS-485/RS-232 7-position plugs
- Connector key

G4LC32ARC

The packing box for the G4LC32ARC contains:

- G4LC32ARC daughter card
- Two RS-485 7-position plugs
- Connector key
- Right angle BNC adapter

If any item is missing, contact Opto 22.

Product Support

If you have any questions, contact Opto 22 Monday through Friday, from 8 am. to 5 pm, Pacific Standard Time at:

Technical Assistance: 951/695-3080
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Fax: 951/695-3017

CHAPTER 1

G4LC32SX Revised Features

G4LC32SX controllers manufactured after April 1994 have been modified and are compatible with the original G4LC32SX controllers. The following table describes the changes.

Table 1-1: Revised Features

Features	New G4LC32SX	Original G4LC32SX
EPROMs	- Uses Flash or UV EPROMs - Firmware update is downloaded to the EPROMs by using the FLASH 200 utility - EPROM size is expandable from 256 KB to 1 MB	- Uses UV EPROMs - Firmware update requires physical removal and installation of UV - EPROM size is 128 KB and is nonexpandable
Jumpers	Jumper groups: AX: Address extender E/R: Run from Flash EPROM or RAM RJ0: EPROM type, size MJ0: RAM size X0, X1: Communication mode	Jumper groups: AX: Address extender E/R: Run from EPROM or RAM
RAM Expansion	256 KB, expandable to 1 MB	256 KB, nonexpandable

IMPORTANT: Connectors wired for other Opto 22 controllers may not be compatible with the G4LC32SX. Use the connectors provided and refer to the configuration label for wiring information.

Use Table 1-2 to select RAM expansion options for your controller.

RAM Size	G4LC32		G4LC32SX		G4LC32ISA	G4LC32ISA-LT	M4RTU/M4IO/M4[3]	
	Original[2]	New[2]	Original[2]	New[2]	----------	----------	Original[3]	New[3]
256K	N/A	N/A	Base Configuration	Base Configuration	Base Configuration	Base Configuration	Base Configuration	N/A
512K	Base Configuration	Base Configuration	N/A	N/A	Buy 2 G4RAM1M	N/A	N/A	N/A
1M	G4LC32RAMEX5M	Buy 4 G4RAM1M	N/A	Buy 2 G4RAM4M	Buy 2 G4RAM4M	N/A	Buy 2 G4RAM4M	Base Configuration
2M	N/A	Buy 4 G4RAM4M	N/A	N/A	Buy 4 G4RAM4M	N/A	N/A	N/A
4M	G4LC32RAMEX4M	Buy 8 G4RAM4M	N/A	N/A	N/A	N/A	N/A	N/A

Use Table 1-3 to select EPROM expansion options for your controller.

Size	G4LC32		G4LC32SX		G4LC32ISA	G4LC32ISA-LT	M4RTU	M4IO	M4
	Original[2] (UV EPROM)	Current[2] (Flash)	Original[2] (UV EPROM)	Current[2]	Flash	Flash	Flash	Flash	Flash
128K	Base Configuration	N/A	Base Configuration	N/A	N/A	N/A	N/A	N/A	N/A
256K	Buy 4 27C512-120[1]	N/A	N/A	Base Configuration	Base Configuration	Base Configuration	Base Configuration	Base Configuration	Base Configuration
512K	Buy 4 27C010-120[1]	Base Configuration	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1M	Buy 4 27C020-120[1]	G4LC32F1M	N/A	G4LC32SXF1M	G4LC32ISAF1M	N/A	M4RTUF1M	M4IOF1M	M4F1M

Notes:

[1] = Chips from Intel (N/A from Opto 22). Older chips had a 256K base configuration.

[2] = See attached to determine if you have a new style G4LC32/G4LC32SX or old style G4LC32/G4LC32SX.

[3] = New controllers are marked with a "1MB RAM installed" sticker.

CHAPTER 2

Introduction

The G4LC32SX Model 200 Controller

The G4LC32SX controller is a local processing unit designed to be used in a mistic Model 200 control system. A mistic controller is the combination of a powerful industrial microcomputer, highly intelligent I/O, an amazing new control language and a better idea for industrial packaging. This combination is designed with one thought in mind – to allow you to quickly and easily implement your industrial control applications.

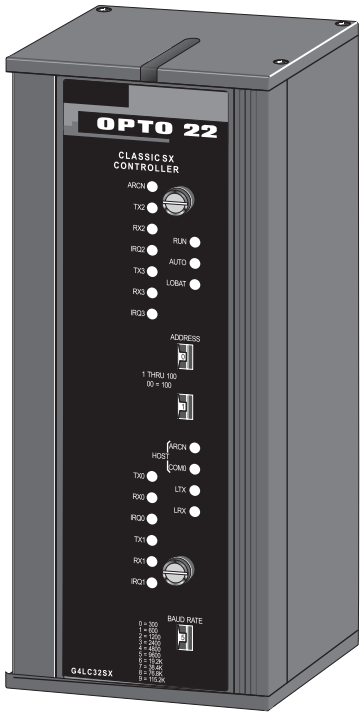


Figure 2-1: G4LC32SX Controller

How A User Application Works

Normally, you would use the G4LC32SX controller to run the applications programs that you have developed on a PC workstation. After your application program has been downloaded to the target G4LC32SX controller and debugged using OptoControl™ or Cyrano®, the PC workstation is no longer needed. The G4LC32SX controller runs your application stand alone. For larger distributed control applications, you can use more than one G4LC32SX controller networked together via a multidrop RS-485 communications port or via the optional ARCNET port. The G4LC32SX application program can easily interface to supervisory and operator interface devices.

I/O Units

The G4LC32SX controller not only handles all the logic to run your application programs but it can communicate with I/O units as well. The G4LC32SX controller can be connected to I/O units in two different ways. First, you can use local I/O units which communicate with the G4LC32SX over a 1.4 MHz parallel bus (a 34-conductor, flat-ribbon cable). The second way is to use remote I/O units which communicate with the G4LC32SX over a two-wire RS-422/485 serial communication link operating at up to 115 KB.

The advantage of local I/O is speed (1.4 MHz). The disadvantage is that you are limited to a maximum distance of 200 feet from the G4LC32SX. As many as 139 local I/O units can be connected to one G4LC32SX. You can mix and match both digital and analog I/O units as needed by your application. Each I/O unit can have up to 16 I/O points (modules), thus one G4LC32SX can control up to 2224 I/O points on the local bus. CRC 16-error detection is included in every message transaction to insure safe, reliable operation. If longer distances and/or more I/O points are required, then panels containing remote I/O units may be added to the system.

The advantage of remote I/O is that you can distribute your I/O over large distances. The G4LC32SX and the remote I/O can be separated by distances up to 3,000 feet (even longer distances with repeater). The disadvantage is a slower baud rate of 115 KB. You can use a single twisted pair of wire to provide cost effective communications over an RS-422/485 communications link. A mistic controller can support three remote I/O links and one host communication link or four remote I/O links when ARCNET is used for host communications. Also four remote I/O links can be used for stand alone applications. As many as 100 (256 with repeaters) remote I/O units can be connected to each remote I/O link. CRC 16-error detection is included in every message transaction to insure safe, reliable operation

Each I/O unit contains a brain board with its own powerful 16-bit 80C196 controller. The controller in the I/O unit performs an incredibly useful set of common control functions like high speed counting and PID control by creating multifunction I/O. As a result, the unburdened G4LC32SX controller can execute control logic with remarkable speed.

The G4LC32SX And Controller Software

The G4LC32SX controller supports OptoControl and Cyrano. It runs a multitasking kernel which can run up to 31 separate charts (tasks) simultaneously. This capability assures safe, reliable operation for your application since each chart will be executed in a maximum of 16 milliseconds. A complicated control application can be segmented by functions enabling each function to be represented by its own unique chart.

Available Options

The G4LC32SX features two combination RS-422/485 or RS-232 ports. Two additional RS-422/485 ports and ARCNET are optional. Baud rates from 300 to 115K can be selected.

One of the two RS-422/485 or RS-232 communications ports, COM0, is dedicated for communications with the remote PC workstation. The optional ARCNET™ port may also be used as the host port. You can also choose to disable the host task under OptoControl or Cyrano 200 and then use the serial port in your application for another use. The other serial ports (up to three) are for use by your applications program. The RS-422/485 ports would typically be used when several serial devices must be connected to one serial communication line. As many as 32 devices can be connected to an RS-422/485 port in a multidrop application. Other typical usages for the RS-422/485 port are:

(1) for applications requiring a high degree of noise immunity

(2) the capability of transmitting over longer line lengths (up to 3,000 ft.)

(3) transmission at higher baud rates.

The two standard serial ports, COM0 and COM1 can be used as RS-232 ports or as RS-422/485 ports. Plug removable terminal blocks are provided for all the connections. The RS-232 ports can be used by your application program to communicate with standard serial devices such as printers, bar code readers, etc

An optional ARCNET port is available for even faster communications between units. You can connect as many as 255 ARCNET devices to the ARCNET bus. The ARCNET bus uses standard RG62A/U coaxial cable. It runs at 2.5 MHz.

A battery backed up real time clock is provided for time dependent tasks.

The G4LC32SX features a front panel with LED status indicators for communications and diagnostics.

Basic Architecture

The G4LC32SX controller's 32/16-bit architecture, 256 KB of battery backed RAM and 256 KB Flash EPROM allows you to execute medium control applications with extensive data collection requirements.

The heart of the G4LC32SX controller is a 32-bit 68020 microprocessor running at 16 MHz, with a 16-bit external bus.

Industry standard networking (ARCNET) support allows multiple mistic controllers to be organized into large, distributed systems.

A block diagram of the G4LC32SX is shown in the following figure.

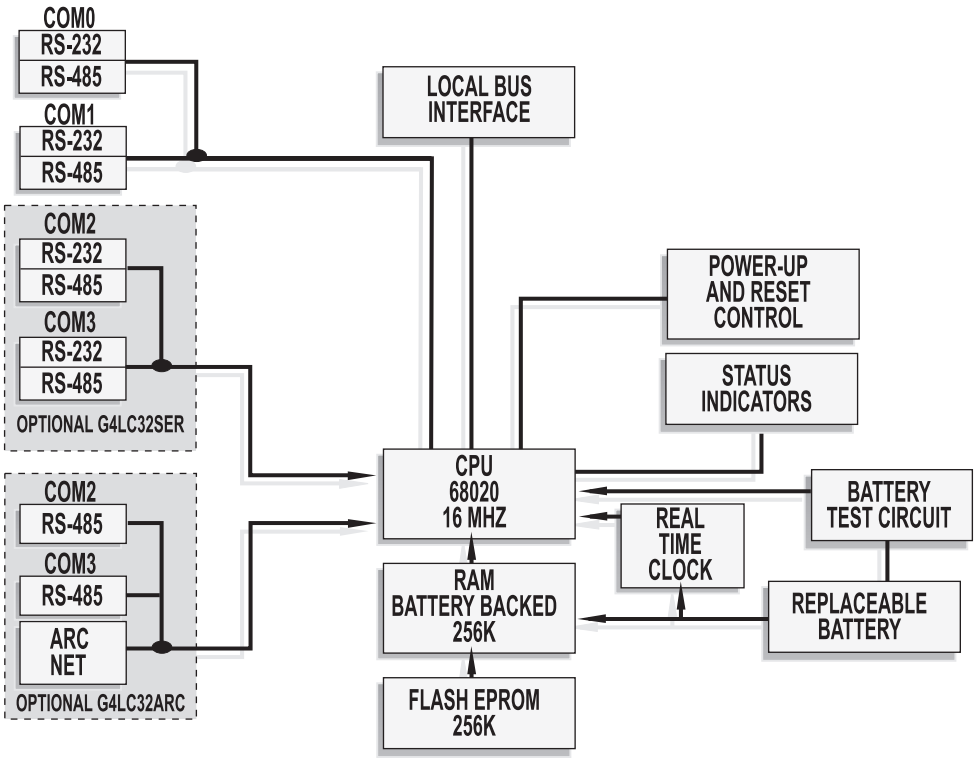


Figure 2-2: G4LC32SX Block Diagram

G4LC32SX Features

Some of the features of the G4LC32SX are as follows:

- 32-bit 68020 controller with 16-bit external bus
- High-speed 16.67 MHz 68020 operation
- Two high-speed (115.2 KBd) serial ports (RS-232 or RS-422/485 ports)
- G4LC32SER expansion card (optional), two RS-232 or RS-422/485 ports
- G4LC32ARC expansion card (optional), ARCNET plus two RS-422/485 ports
- Supports remote and local I/O
- LED indicators for controller, I/O, and communication diagnostics
- 256 KB battery backed RAM, expandable to 1 MB
- 256 KB Flash EPROM, expandable to 1 MB
- Battery-backed real time clock
- Multi-tasking, runs up to 31 user charts simultaneously
- Supports OptoControl and Cyrano
- Controls up to 2,224 points of local I/O
- Controls up to 4,096 x 4 points of remote I/O.

CHAPTER 3

Configuration and Installation

Diagrams

G4LC32SX Controller

The following figure shows the outline and mounting dimensions of the G4LC32SX controller.

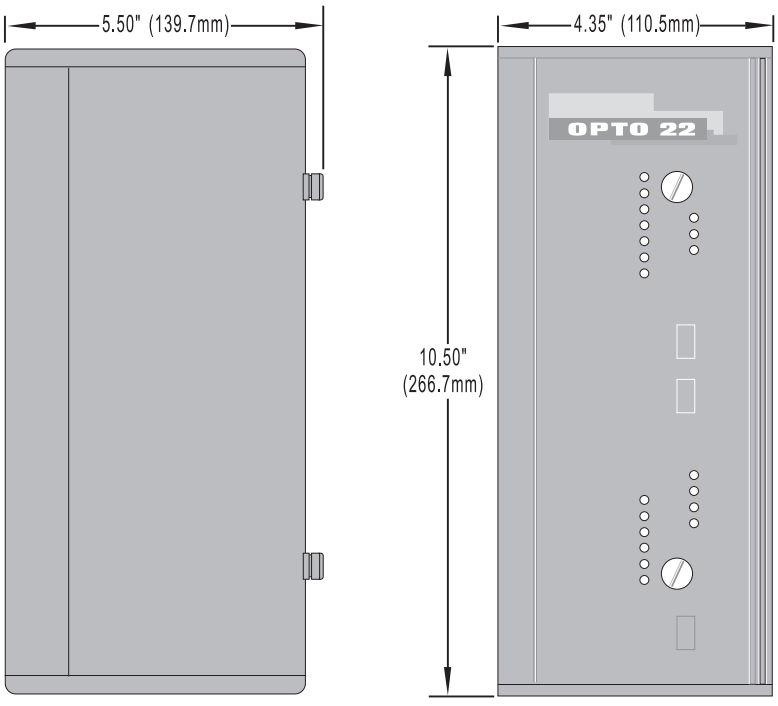


Figure 3-1: G4LCSX Controller

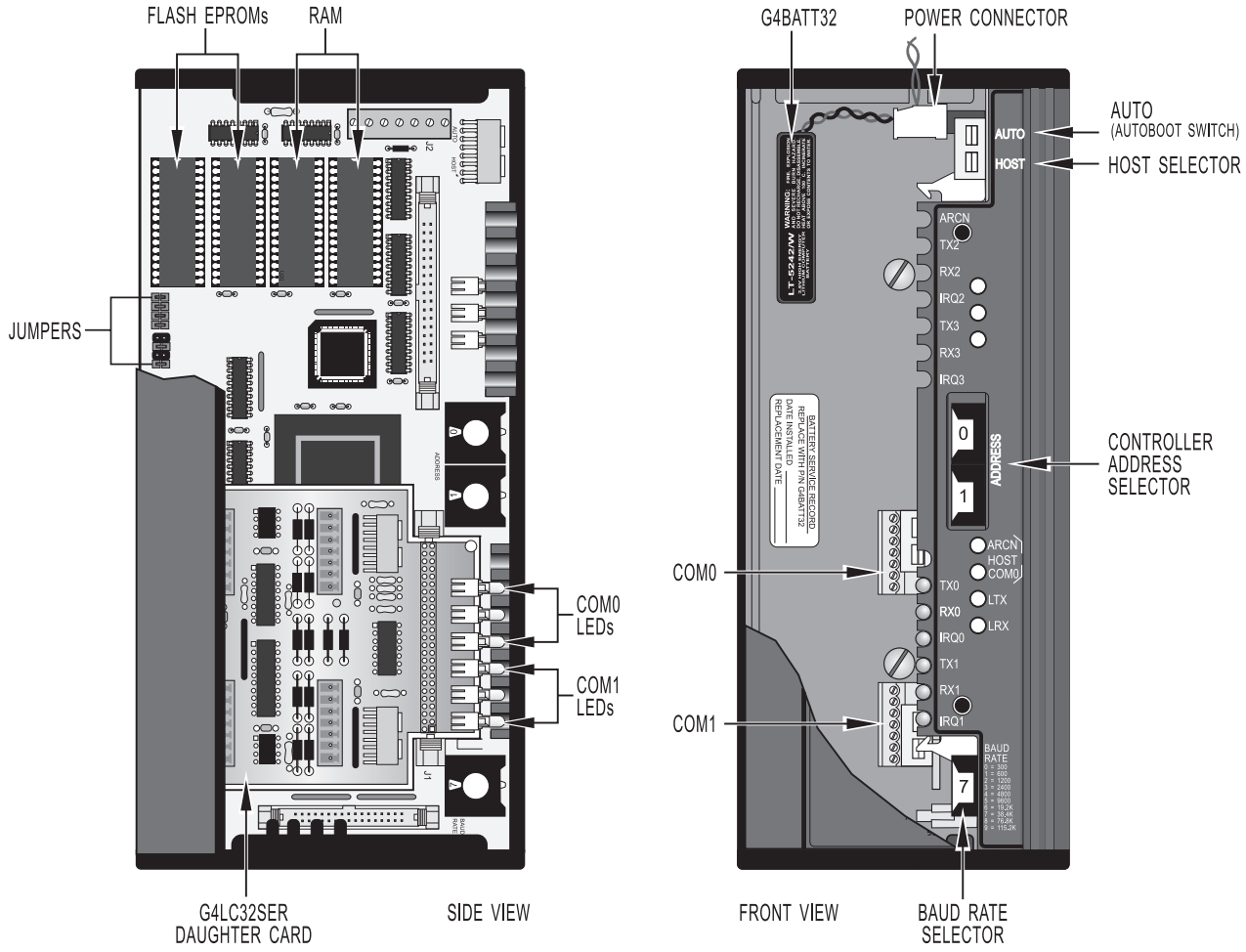


Figure 3-2: G4LC32SX Inside Panel

G4LC32SER Diagram

The G4LC32SER daughter card provides the controller's COM0 and COM1, RS-232 or RS-422/485 serial ports. An additional G4LC32SER card in the controller expands its port connections with COM2 and COM3. When referring to the following diagram, remember one port can be either COM0 or COM2 and the other COM1 or COM3.

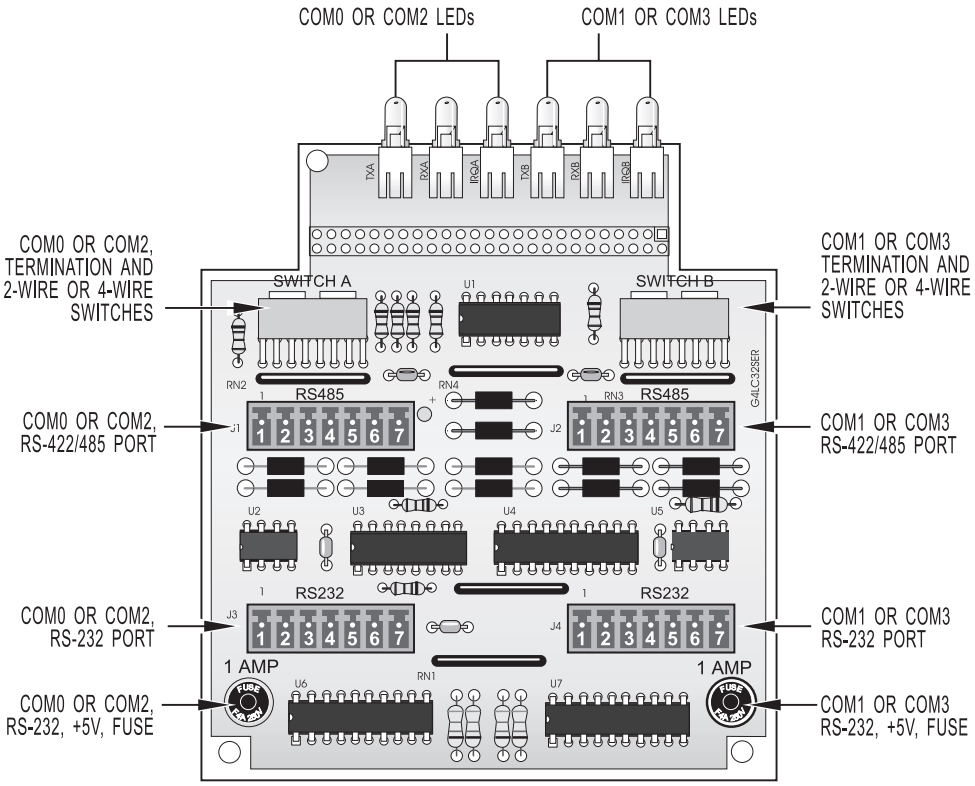

COM0 OR COM2 LEDs
COM1 OR COM3 LEDs
COM0 OR COM2, TERMINATION AND 2-WIRE OR 4-WIRE SWITCHES
COM1 OR COM3 TERMINATION AND 2-WIRE OR 4-WIRE SWITCHES
COM0 OR COM2, RS-422/485 PORT
COM1 OR COM3 RS-422/485 PORT
COM0 OR COM2, RS-232 PORT
COM1 OR COM3 RS-232 PORT
COM0 OR COM2, RS-232, +5V, FUSE
COM1 OR COM3 RS-232, +5V, FUSE
SWITCH A
SWITCH B
RS485
RS232
1 AMP
G4LC32SER

Figure 3-3: G4LC32SER Physical Layout

G4LC32ARC Diagram

The following diagram shows the LEDs and physical layout of the G4LC32ARC daughter card. Functionally, the G4LC32ARC only operates in the top daughter board slot of the controller with its RS-422/485 serial ports as COM2 and COM3.

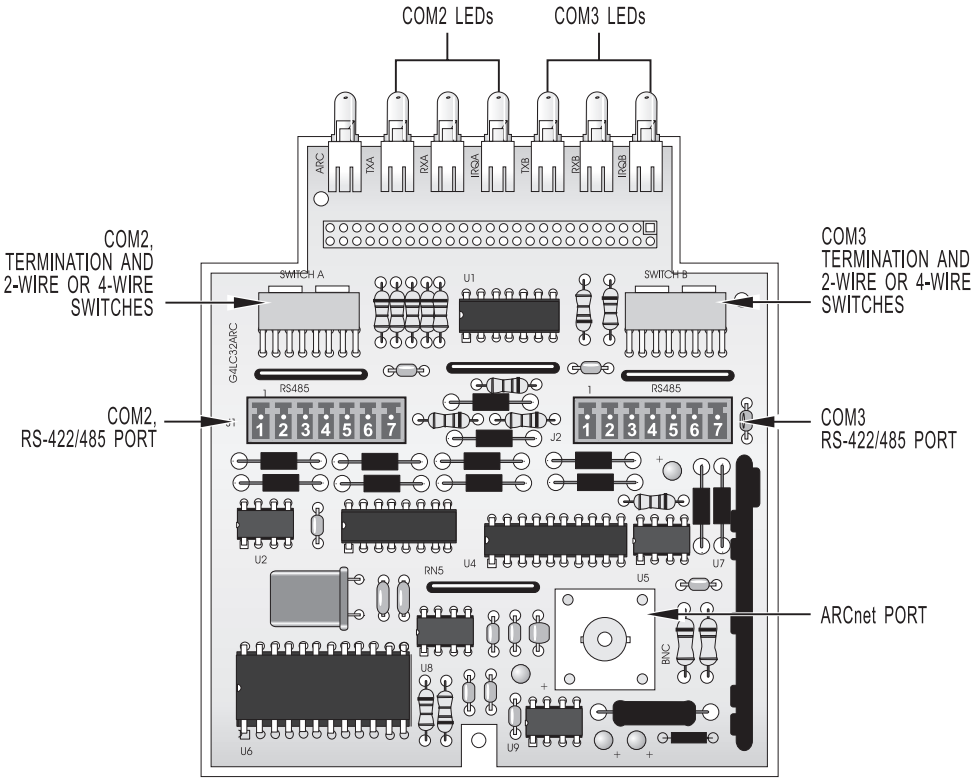


Figure 3-4: G4LC32ARC Physical Layout

Configuration Switches and Jumpers

G4LC32SX Switches

Use the switches on the G4LC32SX to make configuration changes. Use the label affixed to the inside of the G4LC32SX front cover as a quick reference for configuration information.

Activating Setup Changes Activate configuration changes by powering down and then powering up the controller.

ADDRESS Select the host port address with these rotary switches. The standard range is 1-100 (00=100). The upper switch sets the ten's digit and the lower switch sets the one's digit. To extend the address range to 101-200 (00=200), remove the AX (address extension) jumper from the main controller board. To access the AX jumper, remove the daughter board in the COM2 and COM3 slot position if one is installed in your controller.

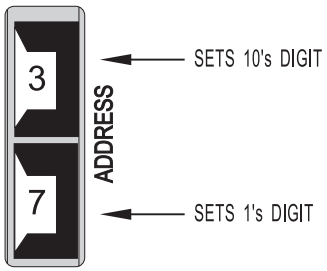


Figure 3-5: Controller Address Selector

AUTO Select the autoboot mode with this switch.

ON Upon power-up or reset, the G4LC32SX automatically runs its resident program. The E/R jumper selects whether to run the program in RAM or the program in the Flash EPROMs.

OFF Upon power-up or reset, the G4LC32SX waits to receive the command to run the resident program.

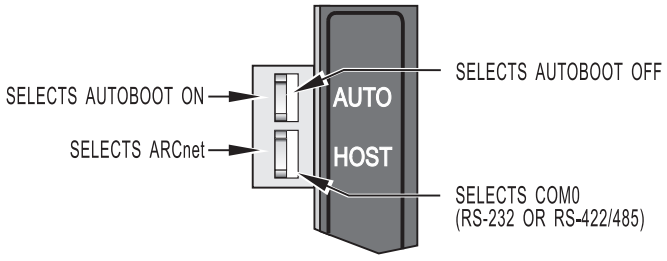


Figure 3-6: Autoboot and Host Switches

BAUD RATE Select the baud rate for COM0 upon power up or reset with this rotary switch. If COM0 is the host port, choose the baud rate from the legend located to the right of the switch.
Example: To select a 38.4 K baud rate, set the switch to "7."

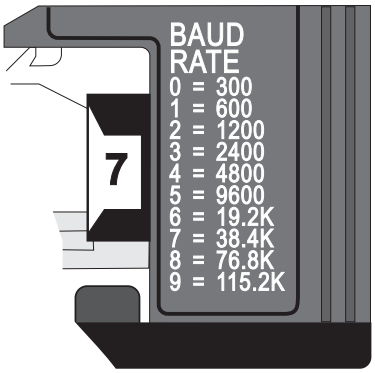


Figure 3-7: Baud Rates

The COM0 baud rate may also be set from OptoControl or Cyrano (software control). COM1, COM2, and, COM3 baud rates are always set using OptoControl or Cyrano.

HOST Select the host port for downloading programs and the user interface upon power-up or reset with this switch. Host port selections are ARCNET or COM0 (RS-232 or RS-422/485).

G4LC32SER and G4LC32ARC Daughter Card Switches

TERM YES–TERM NO

This switch selects termination for the RS-422/485 port. In the YES posi tion, he RS-422/485 lines are terminated. Terminate the port when it is physically the first or last unit in a serial network. Ports using RS-232 (G4LC32SER) communication should have TERM YES selected to ensure a known voltage level on the RS-422/485 inputs. This is necessary due to the OR'ing of the RS-232 and RS-422/485 signals.

In the NO position, the RS-422/485 lines will be floating. This setting should be used when the port is part of a multidrop application and is not physically the first or last unit in the network.

The factory default is TERM YES.

2-Wire–4-Wire

This switch selects the wiring method used to connect to the RS-422/485 serial port. The choices are 2-wire or 4-wire. The factory default is 4-wire.

If you are using the RS-232 serial port (G4LC32SER), set this switch to 4-wire and make sure the TERM YES switch is also set.

G4LC32SX Jumpers

AX Jumper Selects the standard address range of 1 - 100 (jumper installed, factory default) or the extended address range of 101 - 200 (jumper not installed). Refer to the "Address" switch section about setting the controller address.

Bootup Jumper

The X1 jumpers selects between booting to the mistic loader or booting to the mistic kernel. The default setting is boot to kernel.

Table 3-1: Bootup Jumper

X1	Bootup Mode
X	Boot to kernel
:	Boot to loader

Communication Mode Jumper

The X0 jumper selects between binary or ASCII communication mode for the host port. The default setting is binary mode.

Table 3-2: Communication Mode Jumpers

X0	Communication Mode
X	Binary Mode
:	ASCII Mode

EPROM Jumpers

This jumper configures the EPROM type and size. Flash or UV EPROMs may be used. The factory default is 256 KB of Flash EPROM.

Table 3-3: EPROM Jumpers

Flash	RJ0	ROM Type
X	X	27C1001 (1 Mb UV EPROM) (256 KB)
X	:	27C4001 (4 Mb UV EPROM) (1 MB)
:	X	29F040 (1 Mb Flash EPROM)(256 KB)
:	:	29F040 (4 Mb Flash EPROM)(1 MB)

E/R (Run from EPROM/RAM) Jumper

Use this jumper to choose the source of the controller's program. An installed jumper selects RUN from RAM and is the factory default. This option runs the program found in RAM. No jumper installed runs the program found in the Flash EPROMs.

RAM Jumper

The factory default RAM size is 256 KB.

Table 3-4: RAM Jumper

MJ0	RAM Type
X	2 x 1 Mb (256 KB)
:	2 x 4 Mb (1 MB)

Conventions: X = Jumper installed
: = Jumper not installed

Installation

G4LC32SX Installation

This section describes a typical installation of the G4LC32SX onto a remote or local Panel 200. Adapt these instructions to fit your application if you have a custom panel.

To install the G4LC32SX:

1. The G4LC32SX controller has two captive mounting screws. Mount the controller below the G4PS245A/B power supply.
2. Remove the G4LC32SX front cover.
3. Connect the polarized 7-pin connector from the G4PS245A/B power supply to the mating receptacle on the G4LC32SX.

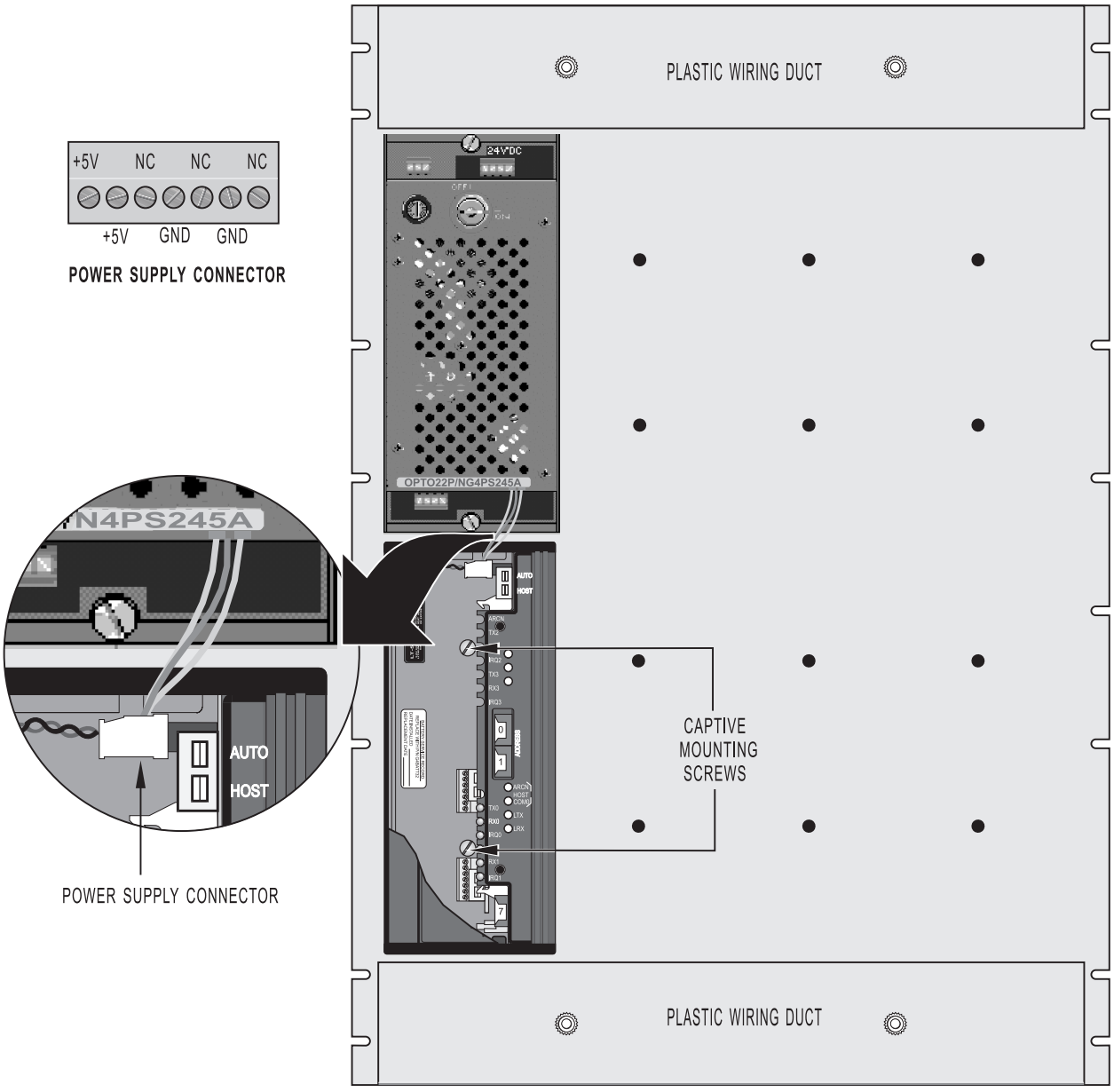


Figure 3-8: Mounting the G4LC32SX and Power Supply in a Mistic Panel

G4LC32SX Daughter Board Installation

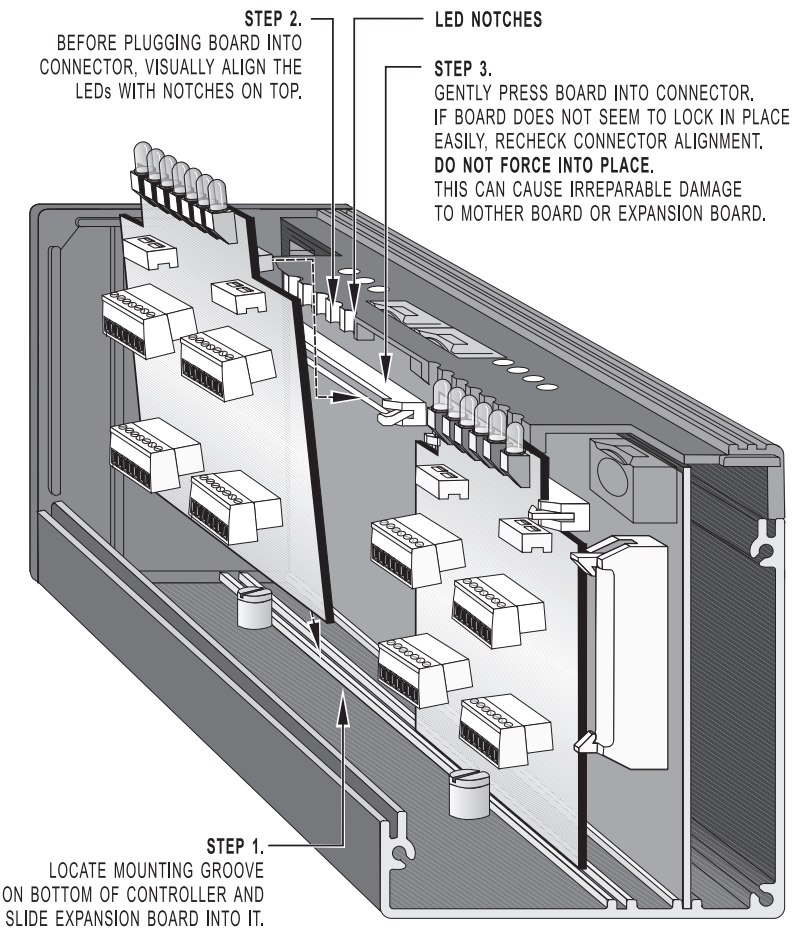

STEP 2.
BEFORE PLUGGING BOARD INTO CONNECTOR, VISUALLY ALIGN THE LEDs WITH NOTCHES ON TOP.
LED NOTCHES
STEP 3.
GENTLY PRESS BOARD INTO CONNECTOR. IF BOARD DOES NOT SEEM TO LOCK IN PLACE EASILY, RECHECK CONNECTOR ALIGNMENT.
DO NOT FORCE INTO PLACE.
THIS CAN CAUSE IRREPARABLE DAMAGE TO MOTHER BOARD OR EXPANSION BOARD.
STEP 1.
LOCATE MOUNTING GROOVE ON BOTTOM OF CONTROLLER AND SLIDE EXPANSION BOARD INTO IT.

Figure 3-9: G4LC32SX Daughter Card Installation

4. Connect the battery connector to its mate, as shown in Figure 3-10. Factory packed controllers are shipped with the battery disconnected. The battery is located inside the controller mounted to the base with a Velcro® strip.

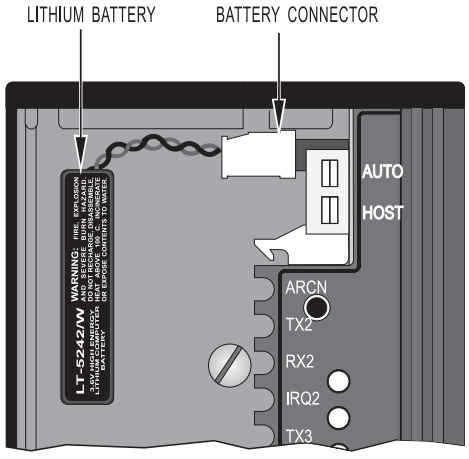


Figure 3-10: Connecting the RAM Backup Battery

Fill out the replacement date sticker. The shelf life of the 3.6 V lithium battery is over 10 years and the operational life of the battery ranges from 2 to 5 years. Replace the battery after 2 years if the controller is installed in a damp or dusty environment. The battery replacement is P/N G4BATT32.

RAM and EPROM Installation

The RAM and EPROMs are found on a circuit board underneath the optional daughter board. You can expand the G4LC32SX's RAM from 256 KB to 1 MB, and the Flash EPROM size from 256 KB to 1 MB. UV EPROMS are 128 KB and are nonexpandable.

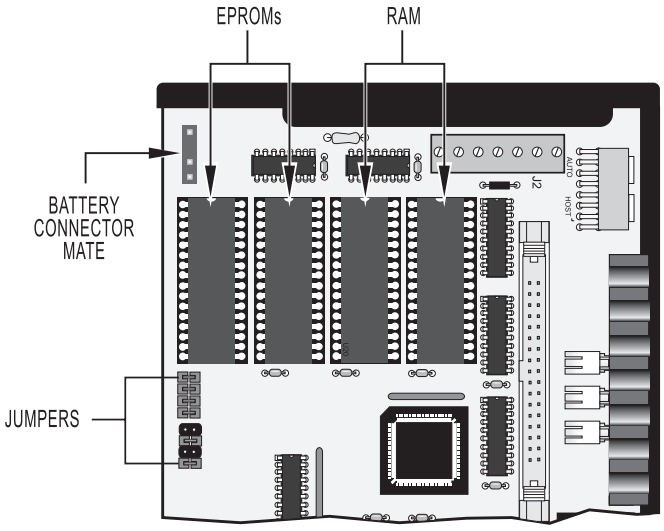


Figure 3-11: Location of EPROMS and RAM

Procedure:

1. Turn off power to the controller.
2. Remove the controller's front cover.
3. Remove the optional daughter board (COM2 and COM3) if one is installed.
4. Refer to the Figure 3-11 to locate the RAM and EPROM chips.
5. Make your expansion changes on the mother board by referring to the "G4LC32SX Jumpers" section of this same chapter.
6. Replace the daughter board if one was removed.
7. Replace the controller's front cover.
8. Apply power to the controller.

CHAPTER 4

Serial Communications

Overview

The G4LC32SX controller is shipped with a G4LC32SER daughter board for COM0 and COM1 serial communications. Additional serial ports are available by using either the G4LC32SER or G4LC32ARC daughter board for COM2 and COM3. These cards expand the G4LC32SX controller to a total of four serial ports. An ARCNET port is also available if the G4LC32ARC is used.

G4LC32SER Two combined full-duplex RS-422/485 or RS-232 serial ports with a baud rate range of 300 to 115.2 KBd.
COM0 and COM1
Optional: COM2 and COM3

G4LC32ARC Two full-duplex RS-422/485 serial ports with a baud rate range of 300 to 115.2 KBd. One ARCNET port with a 2.5 Mb/s transfer rate.
Optional: COM2 and COM3

The G4LC32SX and remote I/O units can be separated by distances of up to 3,000 ft. (even longer distances with an AC38 repeater). A single shielded twisted-pair of wire provides communications over an RS-422/485 communications network to up to 100 (256 with repeaters) remote I/O units.

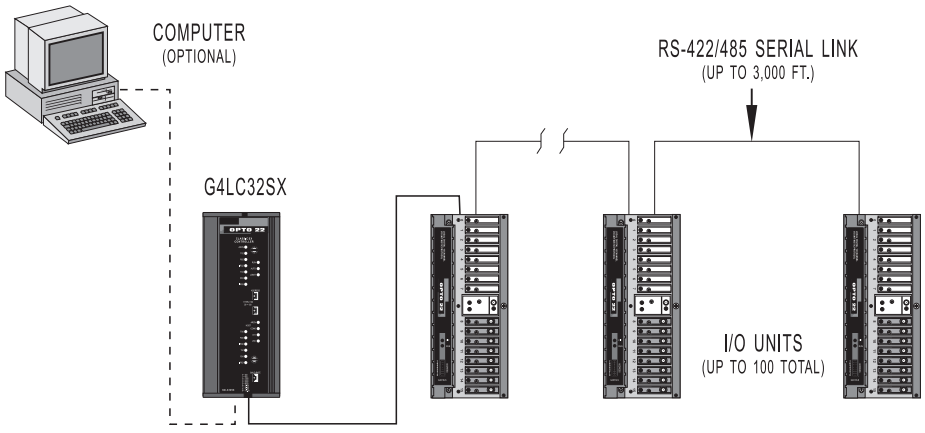


Figure 4-1: G4LC32SX at End of Network

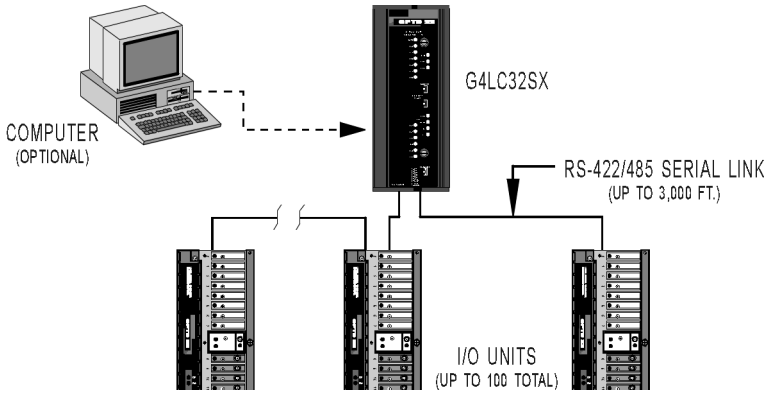


Figure 4-2: G4LC32SX in Middle of network

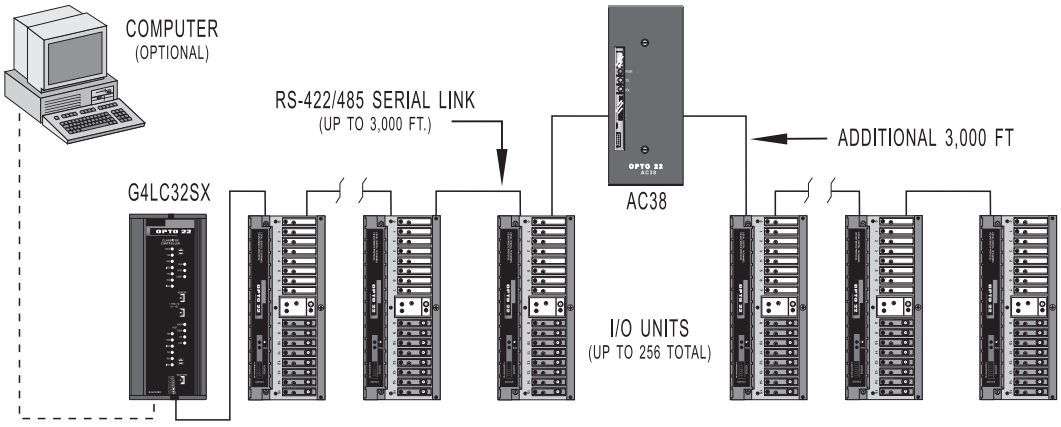


Figure 4-3: G4LC32SX with >100 Units in Middle of network

Cables and Connectors

RS–422/485 Cables

Shielded, twisted-pair wires are recommended for the communications wiring.

Typical wire types are:

1. Two-pair – Individually shielded pairs (2 pair) PVC chrome jacket

   Belden P/N 9729
   (#24 gauge – 7x32 stranded, 100 ohm nom. imp., 12.5 pf./ft.)

2. Two-pair – Individually shielded pairs (2 pairs) and overall shield

   A. Belden P/N 8162
   (#24 gauge – 7x32 stranded, 100 ohm nom. imp., 12.5 pf./ft.)

   B. Manhattan P/N M3475
   (#24 gauge – 7x32 stranded, 100 ohm nom. imp., 12.5 pf./ft.)

   C. Manhattan P/N M39249
   (#24 gauge – 7x32 stranded, 100 ohm nom. imp., 12.5 pf./ft.)

3. Four-pair – Individually shielded pairs (4 pairs) PVC chrome jacket

   Belden P/N 9728
   (#24 gauge – 7x32 stranded, 100 ohm nom. imp., 12.5 pf./ft.)

4. Four-pair – Individually shielded pairs (4 pairs) PVC chrome jacket

   A. Belden P/N 8164
   (#24 gauge – 7x32 stranded, 100 ohm nom. imp., 12.5 pf./ft.)
   B. Manhattan P/N M3477
   (#24 gauge – 7x32 stranded, 100 ohm nom. imp., 12.5 pf./ft.)
   C. Manhattan P/N M39251
   (#24 gauge – 7x32 stranded, 100 ohm nom. imp., 12.5 pf./ft.)

RS–232 Cables

Cables suitable for RS-232 wiring are:

1. Belden #8132 (4-conductor #28 gauge)
2. Belden #8133 (6-conductor #28 gauge)
3. Belden #8134 (8-conductor #28 gauge)
4. Belden #8102 (4-conductor #24 gauge)
5. Belden #8103 (6-conductor #24 gauge)
6. Belden #8104 (8-conductor #24 gauge)

Connectors

Green Pluggable 7 Position Terminal Mini-Plug
Used for G4LC32SER, RS-422/485 or RS-232 connections and G4LC32ARC RS-422/485 connections:
Manufacturer: Phoenix Contact
P/N MC1, 5/7-ST-3, 81

Pluggable 7 Position Terminal Plug
Used for G4LC32SX power connections:
Manufacturer: Phoenix Contact
P/N MVSTBW 2, 5/7-ST-5, 08

Wiring

IMPORTANT: Connectors wired for other Mistic 200 controllers may not be compatible with the G4LC32SX. Use the connectors provided and refer to the configuration label for wiring information.

The following sections describe wiring for the serial ports found on the G4LC32SER and G4LC32ARC daughter cards. Use the tables to wire the pluggable 7-terminal block serial ports.

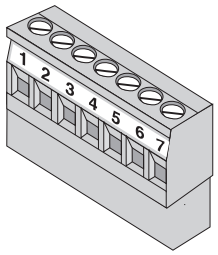


Figure 4-4: Terminal Block

RS–232 Pin Connections

Two RS-232 serial ports are found on the G4LC32SER daughter card. NOTE: When using a RS-232 serial port, do not use the corresponding RS-422/485 COM port. The ports can only be used in one communication mode at a time.

Table 4-1: RS-232 Pin Connections

Pin	Description
1	Fused + 5V (1A)
2	Transmit (TX)
3	Receive (RX)
4	Request-to-Send (RTS)
5	Clear-to-Send (CTS)
6	DTR (Pull up to + 9 V)
7	Ground (GND)

RS–422/485 Pin Connections

Two RS-422/485 serial ports are found on each G4LC32SER and G4LC32ARC daughter card.

NOTE: On a G4LC32SER card, do not use the corresponding RS-232 COM port. The ports can only be used in one communication mode at a time.

Table 4-2: RS-422/485 Pin Connections

Pin	2-Wire Mode	4-Wire Mode
1	Transmit/Receive Plus (TX/RX +)	Transmit Plus (TX +)
2	Transmit/Receive Minus (TX/RX -)	Transmit Minus (TX -)
3	Common Grouond (GND)	Common Ground (GND)
4	No Connection (N/C)	Receive Plus (RX +)
5	No Connection (N/C)	Receive Minus (RX -)
6	Interrupt Plus (IRQ +)	Interrupt Plus (IRQ +)
7	Interrupt Minus (IRQ -)	Interrupt Minus (IRQ -)

Fusing for RS–232 +5V

A + 5 VDC fused source is available on the G4LC32SER daughter card from the RS-232 ports' pin 1. A maximum 0.5 A load can be drawn through the 1 A rated fuse. The replacement part number for this fuse is Opto 22 P/N FUSE01G4 (Wickman P/N 19373A).

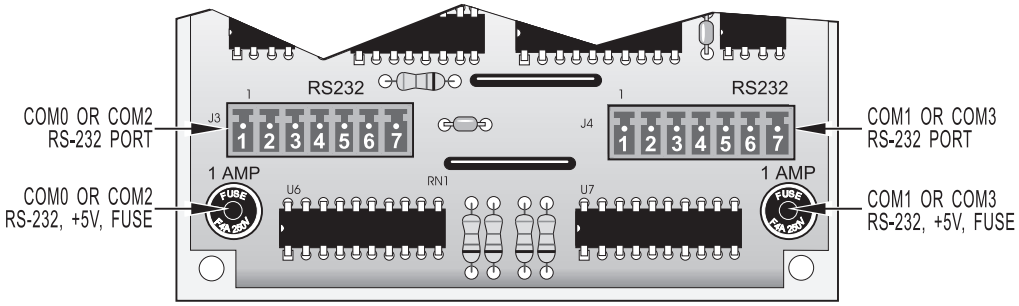


Figure 4-5: G4LC32SX RS-232 Fuses

Connections to a Host PC

RS–422/485 Wiring to Host PC

4-wire Mode Using an AC24AT or AC422AT

If you are using an Opto 22 RS-422 card (Model AC24AT or AC422AT), the cable will have a male, 9-pin "D" shell connector at the PC end and a pluggable terminal block on the controller end. The cable is wired as shown in the diagram below.

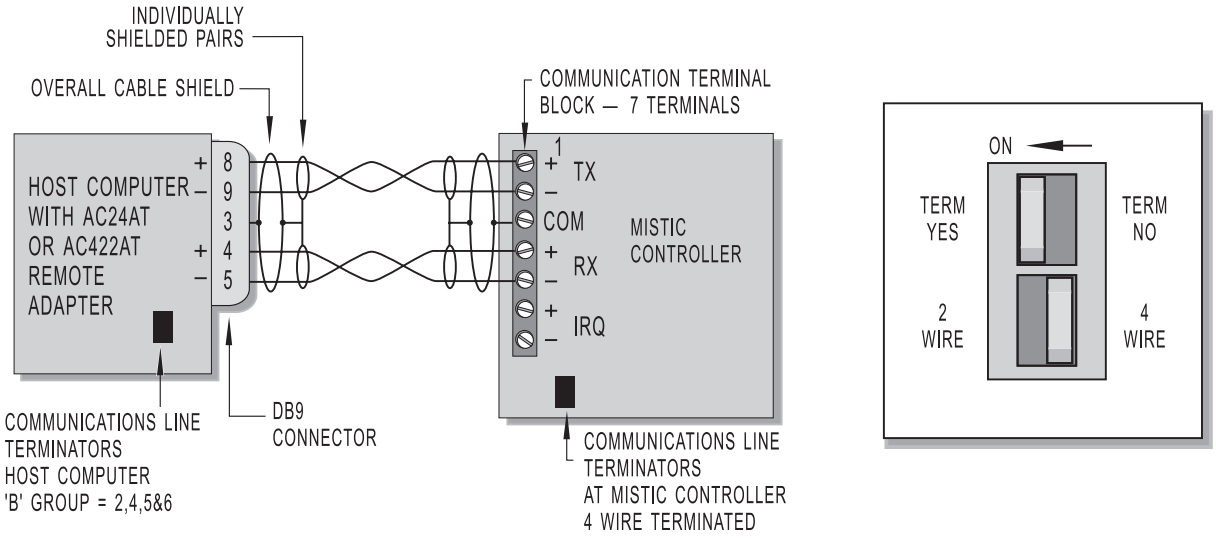


Figure 4-6: RS-422/485 Wiring to Host PC (4-wire mode)

2-wire Mode Using an AC37

If you are using an Opto 22 AC37, the cable will have a male, 9-pin "D" shell connector at the PC end and a pluggable terminal block on the mistic 1 controller end. The AC37 can be wired to detect interrupts initiated from a brick. Refer to the diagram below for wiring.

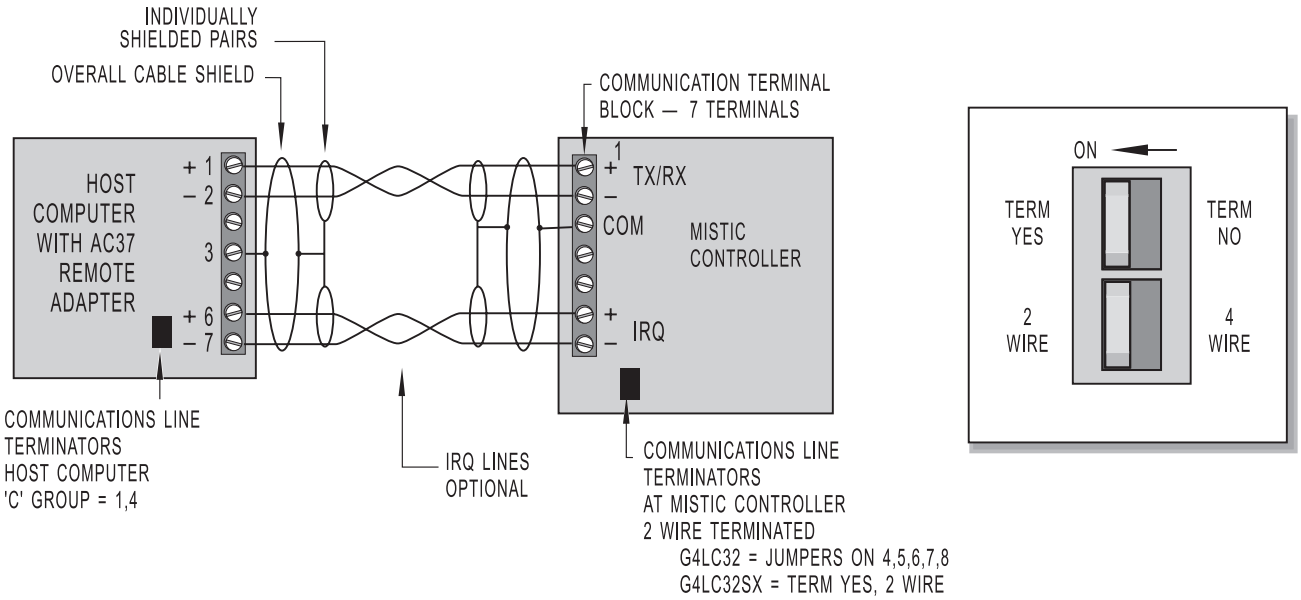


Figure 4-7: RS-422/485 Wiring to Host PC (2-wire mode)

2-wire Mode Using an AC24AT or AC422AT

The cable will have a male, 9-pin "D" shell connector at the PC end and a pluggable terminal block on Mistic controller end. See the diagram below for wiring.

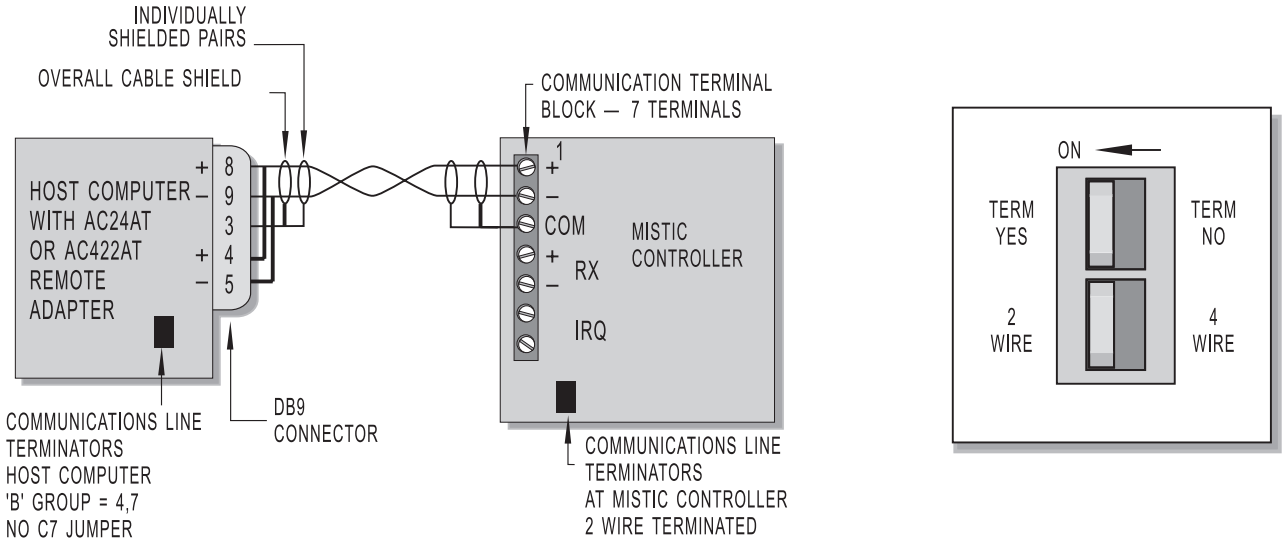


Figure 4-8: Two-wire Mode Using AC24AT or AC422AT

RS–232 Wiring to a Host PC

IMPORTANT: Select 4-wire termination on the corresponding RS-422/485 communication port switch to insure reliable RS-232 communications.

Make RS-232 communication connections to a host PC by using the RS-232 terminals on the G4LC32SER daughter board.

See the following diagram to connect the G4LC32SX to an AT type host computer. Verify pin connections at the host computer are the same as called out in the diagram.

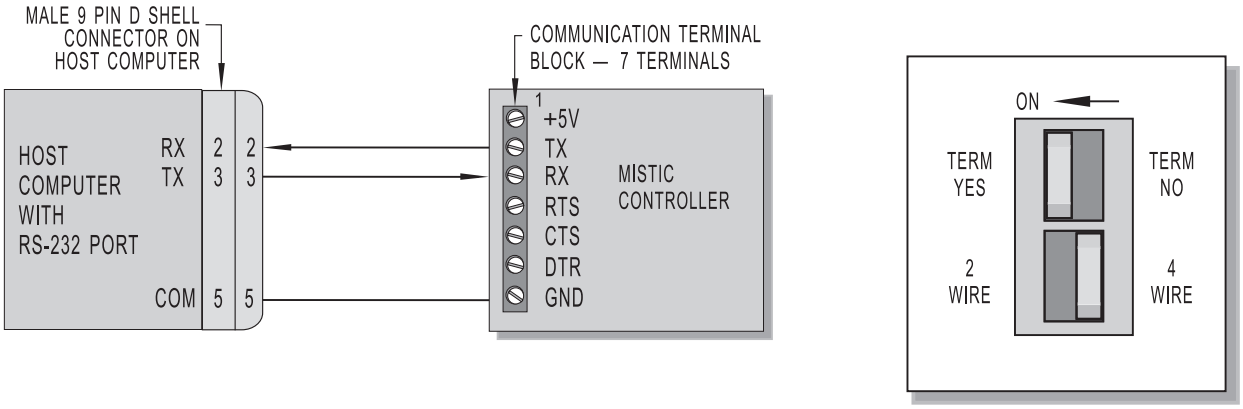
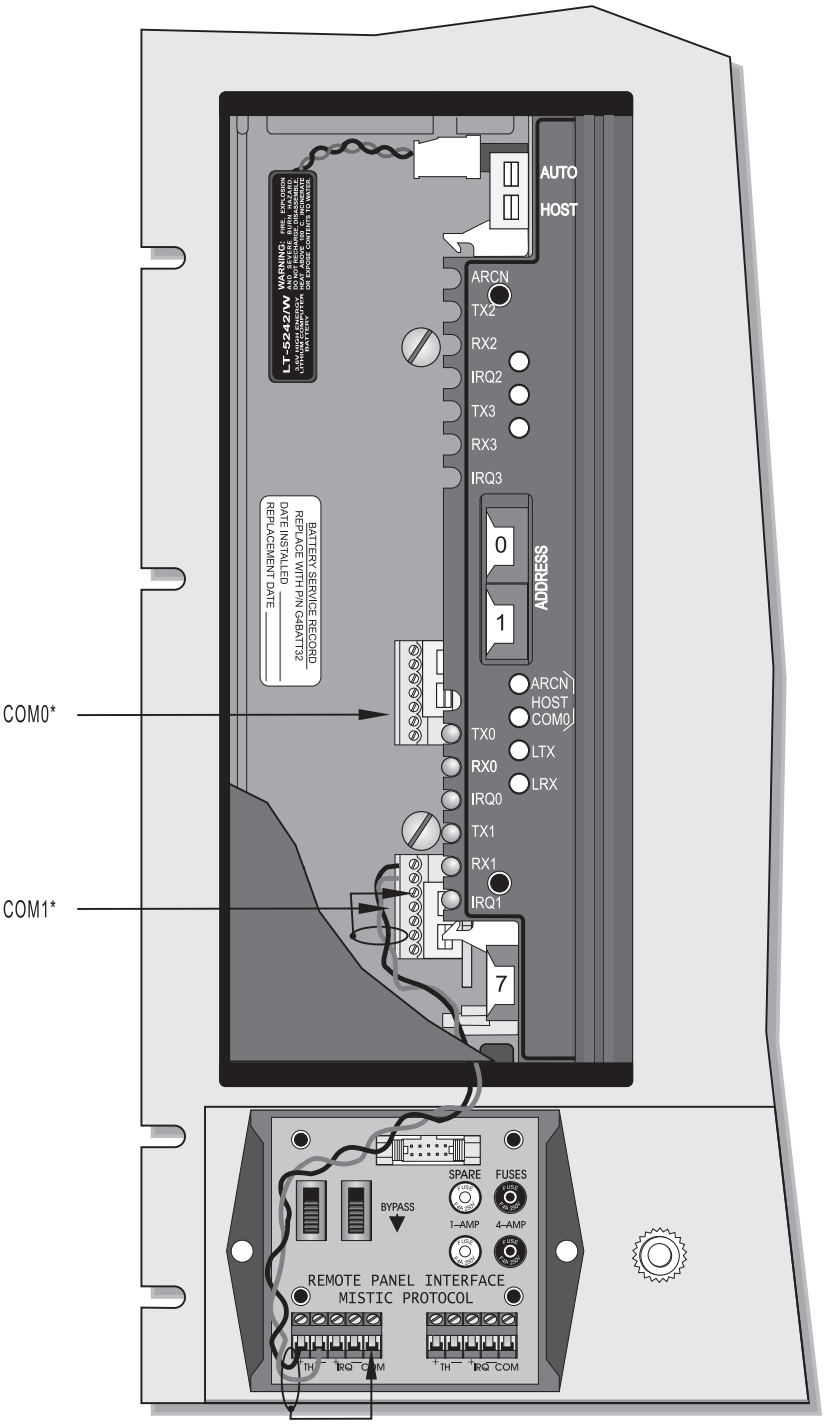


Figure 4-9: RS-232 Wiring to Host PC

Connections to a Remote Interface (G4IOR)

The following diagram shows a typical 2-wire, RS-422/485 shielded wire connection from COM1 on the G4LC32SX to the G4IOR Remote Interface. Connect Pin 1 (TX/RX+) to G4IOR "TH+", Pin 2 (TX/RX-) to G4IOR "TH-", and Pin 3 to "COM". If you are using the interrupt lines, connect Pin 6 to "IRQ+" and Pin 7 to "IRQ-".



*THERE ARE TWO GREEN BLOCKS FOR EACH COM PORT. FOR RS-422/485 CONNECTIONS, USE THE BLOCK CLOSEST TO THE FRONT OF THE CONTROLLER, NEAREST THE BLUE SWITCH.

Figure 4-10: Connections to Remote Interface (G4IOR)

Local Communications

Overview

The local bus is a high speed parallel interface communicating at over 1.4 MB/s and can be up to 200 ft. in length. It connects the G4LC32SX controller to local digital and analog I/O units.

Table 4-3: Local I/O Bus Specifications

Local I/O Bus Specifications	
No. of Active Lines	12
No. of Ground Lines	17
No. of Conductors in Cable	34
Cable Type	Flat Ribbon
Bus Drivers	Open Collector
Impedance	100 ohm
Propagation Delay	1.7 ns/ft.
Max Bus Length	200 ft.
Bus Times	Adjusts between 200 and 700 ns and are distance proportional
Reset Line	None
Interrupts	Available
Digital Response Time	1 ms + Local Bus transmission time
Analog Response Time	3 to 7 ms + Local Bus transmission time
Bus Speed	1.4 MHz

Connectors and Cables

The local bus uses a 34-conductor, flat-ribbon cable. Ports to make custom local bus cables are listed in the following table.

Table 4-4: Manufacturers of Connectors and Cables

Manufacturer		
Ribbon Cable	**3M P/N**	**Alpha P/N**
Regular	3365/34	3580/34 or 3583/34
Ground Planed	3469/34 or 3476/34	3584/34
Jacketed	3603/34	3589/34
Jacketed and Ground Planed	3517/34	3590/34
----------	**3M P/N**	**Circuit Asssembly**
Connectors	3414-7000	CA-34IDS-B

Wiring

The local bus cable uses 12 active lines and 17 ground lines. The address/data bus share the same line.

Table 4-5: Wiring of Signal Functions

Pin	Signal Function
3	A/D master, 1 = address or 0 = data select
9	IRQ interrupt request
11	DTAK active low
15	DS active low
19	D0 data line or A0 address
21	D1 data line or A1 address
23	D2 data line or A2 address
25	D3 data line or A3 address
27	D4 data line or A4 address
29	D5 data line or A5 address
31	D6 data line or A6 address
33	D7 data line or A7 address

ARCNET

Overview

The G4LC32SXARC daughter board is the ARCNET expansion board for the G4LC32SX and can be used as a host port from the controller.

For large, distributed control applications, more than one G4LC32SX controller can be networked on a ARCNET bus.

IMPORTANT: Use passive or active hubs to connect multiple controllers on a network.

Table 4-6: ARCNET Port Specifications

ARCNET Port Specifications	
Transfer rate	2.5Mb/s
Termination	93 ohms
Address range	1 to 255, 0 is not allowed
Topology	Star, bus, and ring (only star is supported by mistic controllers)
Cable type	RG62A/U
Connector type	BNC connector
Normal signal levels	20 VPP output, 7.5 VPP input
Minimum signal levels	16 VPP output, 6.0 VPP input
Access time	Deterministic (token passing)

Maximum cable lengths for ARCNET configurations are shown in the following table.

Table 4-7: Maximum ARCNET Cable Distances

Total network distance (end to end)	20,000 ft.
Active hub to active hub	2,000 ft.
Active hub to mistic controller (or to Host PC)	2,000 ft.
Active hub to passive hub	100 ft.
Passive hub to mistic controller (or to Host PC)	100 ft.

Cables and Connectors

The following is suggested cable wire and connectors to make your custom ARCNET cable.

Cable Wire: RG62A/U Coaxial Cable
Manufacturer: Belden

Connectors: BNC Connectors

Terminators: 93 Ohms

LEDs

G4LC32SX LEDs

The group of LEDs seen from the G4LC32SX front panel is a combination of Processor Status LEDs and LEDs from each of the G4LC32SX daughter boards. The installed daughter boards determine which LEDs light up.

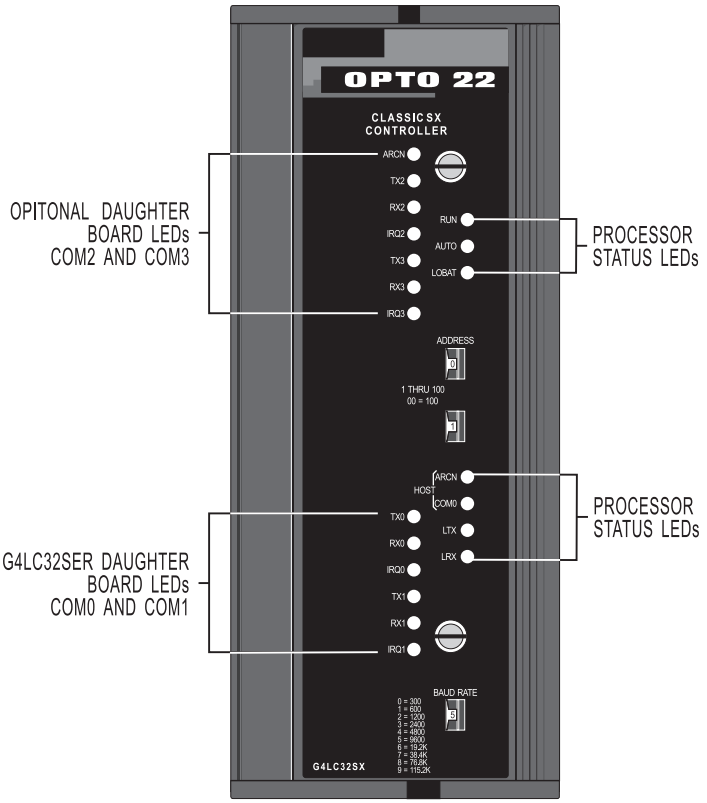


Figure 4-11: G4LC32SX LEDs

Table 4-8: Processor Status LEDs

LED	Description
RUN	Controller is ON
AUTO	Controller is in Autoboot Mode
LOBAT	3.6 V lithium battery (G4BATT32) is low
ARCN	ARCNET is the host port
COM0	COM0 (RS-232 or RS-422/485) is the host port
LTX	Local port is transmitting
LRX	Local port is receiving

G4LC32SER LEDs

The G4LC32SER card has three diagnostic LEDs for each communication port. The following table describes the LEDs.

Table 4-9: G4LC32SER LEDs

LED	Description
TX0	Transmit LED for COM0
RX0	Receive LED for COM0
IRQ0	Interrupt (IRQ) LED for COM0
TX1	Transmit LED for COM1
RX1	Receive LED for COM1
IRQ1	Interrupt (IRQ) LED for COM1

G4LC32ARC LEDs

The G4LC32ARC card has three diagnostic LEDs for each serial communications port, and one diagnostic LED for the ARCNET port. The following table describes the LEDs.

Table 4-10: G4LC32ARC LEDs

LED	Description
ARCN	ARCNET connection is active
TX2	Transmit LED for COM2
RX2	Receive LED for COM2
IRQ2	Interrupt (IRQ) LED for Com 2
TX3	Transmit LED for COM3
RX3	Receive LED for COM3
IRQ3	IRQ LED for COM3

LED Functional Descriptions

ARCN Lights when the Host Port Selector switch is set to ARC. If ARCNET is the host port and this LED is not on, check the Host Post Selector switch is in the correct position.

AUTO Lights when the controller is in the AUTOBOOT mode. This mode is turned on and off by the AUTOBOOT mode selector switch. If this LED is not on and the controller should AUTOBOOT, check the AUTOBOOT selector switch is in the ON position.

COM0 Lights when the Host Port Selector switch is set to COM0. If COM0 is the host port and the LED is not on, check the Host Port Selector switch is in the correct position.

IRQ Lights when a hardware interrupt is initiated by a brick. The LED is off when there are no interrupts or when an interrupt is reset with software.

LOBAT Flashes when the RAM backup battery (P/N G4BATT32) is low. This LED should be off under normal operation. Replace the battery when this LED flashes.

LRX Flashes when the controller is receiving on the local port. Failure to flash when communication is expected could indicate a broken cable or a poor cable connection.

LTX Flashes when the controller is transmitting on the local port. Failure to flash when transmission is expected could indicate the local port was not selected in the application program.

RUN Lights when the controller is ON and is sufficiently powered. A flashing LED could indicate improper Flash EPROM installation, an unsuccessful firmware download, or insufficient power to the controller.

RX Flashes when the controller receives information. Failure to flash could indicate a broken wire or a wrong wire connection.

TX Flashes when the controller is transmitting over the serial port. Failure to flash when transmission is expected could indicate the wrong serial port was selected in the application program.

CHAPTER 5

Software and Firmware

FactoryFloor Software

The G4LC32SX is designed to work with Opto 22's FactoryFloor software. FactoryFloor is an integrated suite of industrial control software applications.

OptoControl, the foundation of the FactoryFloor suite, is an intuitive, graphical flowchart-based development environment that lets you develop and debug control applications without knowing computer programming.

OptoDisplay, another component of FactoryFloor, provides full-featured HMI capabilities with advanced trending and multimedia.

Firmware Updates

Firmware for the G4LC32SX must match the version of FactoryFloor you are using. For OptoKernel firmware updates and more information on FactoryFloor, visit our Web site at www.opto22.com or contact Opto 22 Product Support.

RAM and Flash EPROMs

The G4LC32SX has 256 KB of battery backed RAM and 256 KB of Flash EPROM. Both RAM and the EPROMs can be expanded to 1 MB. Refer to the "RAM and Flash EPROM Installation" section in Chapter 1 for expansion installation instructions.

Running from Flash EPROM and Making Changes

If you want to make changes to an application that has been running from Flash EPROM, make the changes from the debugger and run the program. If you are satisfied with the changes, use the "Burn Strategy Into Flash" command found in the Debugger's "Controller" Top Menu Bar.

CHAPTER 6

Hardware Specifications

G4LC32SX Hardware Specifications

CPU:	Motorola 68,020 32-bit microprocessor 16-bit external bus
CPU clock frequency:	16.67 MHz
Flash EPROM:	256 KB Flash
RAM:	256 KB CMOS with battery backup
Watchdog timer:	Standard, hardware
Real-time clock:	Clock/calendar, Epson 62421A, with battery backup
Communications:	Two full-duplex combined RS-232 or RS-422/485 serial ports @ 115.2 KBd
Ram/Clock Battery:	3.6 V lithium, nonrechargeable
Battery life:	Two years under normal operating conditions
Power requirements:	5 VDC ± 0.1 V @ 2.0 A
Weight:	1.3 kg (1.5 kg with two daughter boards)
Operating temperature:	0°C to 70°C
Storage temperature:	-25°C to 85°C
Humidity:	5% to 95% relative humidity
Software:	Supports Cyrano 200
Options:	G4LC32ARC with two full-duplex RS-422/485 serial ports @115.2 KBd and one ARCNET port
	G4LC32SER with two combined full-duplex, RS-422/485 or RS-232 serial ports @ to 115.2 KBd.

NOTE: Operation at or near maximum rated temperature for extended periods of time may adversely affect reliability.

G4LC32SER Hardware Specifications

Power requirements:	5 VDC ± 0.25 V @ 0.5 A
Operating temperature:	0°C to 70°C
Storage temperature:	-25°C to 85°C
Humidity:	5% to 95% Relative Humidity
Baud rate:	300 – 115.2 KBd (All ports)
RS-485:	2-wire or 4-wire
RS-232:	TX, RX, Gnd, RTS, CTS
Weight:	0.1 kg

G4LC32ARC Hardware Specifications

Power requirements:	5 VDC ± 0.25 V @ 0.5 A
Operating temperature:	0°C to 70°C
Storage temperature:	-25°C to 85°C
Humidity:	5% to 95% Relative Humidity
Baud rate:	300 – 115.2 KBd (All ports)
RS-485:	2-wire or 4-wire
ARCNET transfer rate:	2.5 Mb/s
Weight:	0.1 kg